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(54) **ELECTRONIC TIMER**

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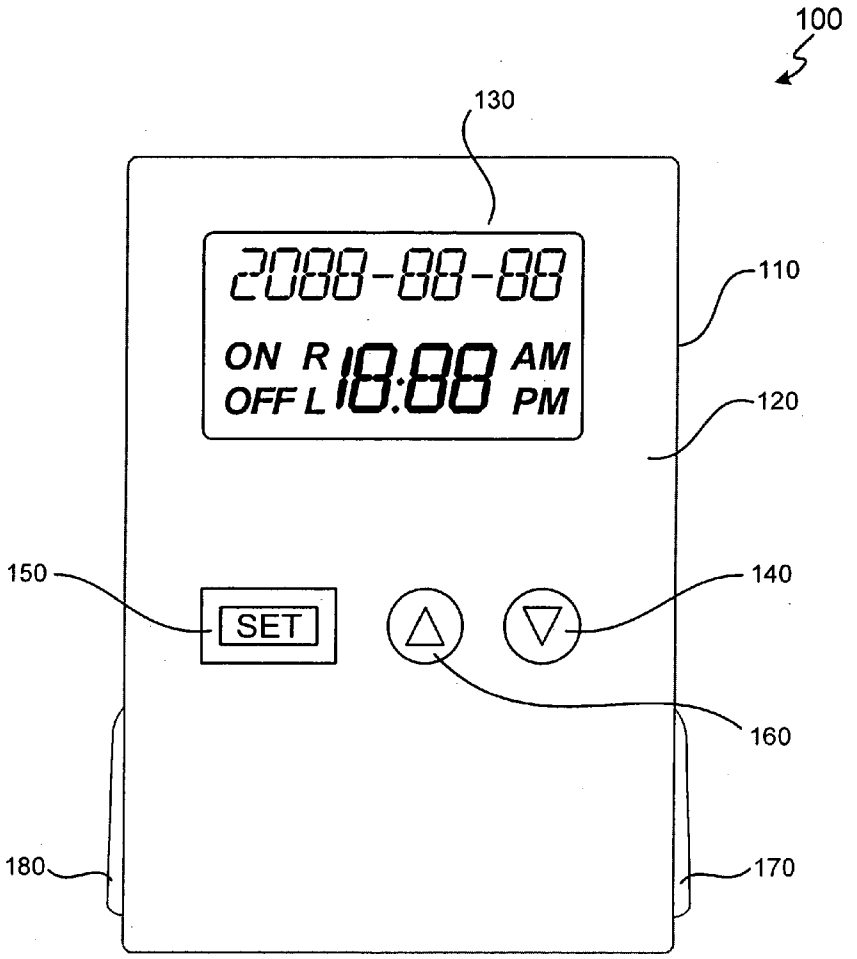
(57) **ABSTRACT**

An electronic timer having a memory for storing programming information including astronomical sunset, sunrise, evening, dawn or twilight data for at least one geographic location, a processor for generating a time controlled signal; and a switch, responsive to the time controlled signal, for receiving an input power from a power supply and coupling the input power to at least one AC socket. The astronomical data can be used in setting an operating time corresponding to the geographic location of the user. Each AC socket can operate independently from the other. The electronic timer further includes a random selection unit used to randomly select an activation and/or deactivation times based on a number of setting parameters that provides a different operating time for each day of the year and for each AC socket.



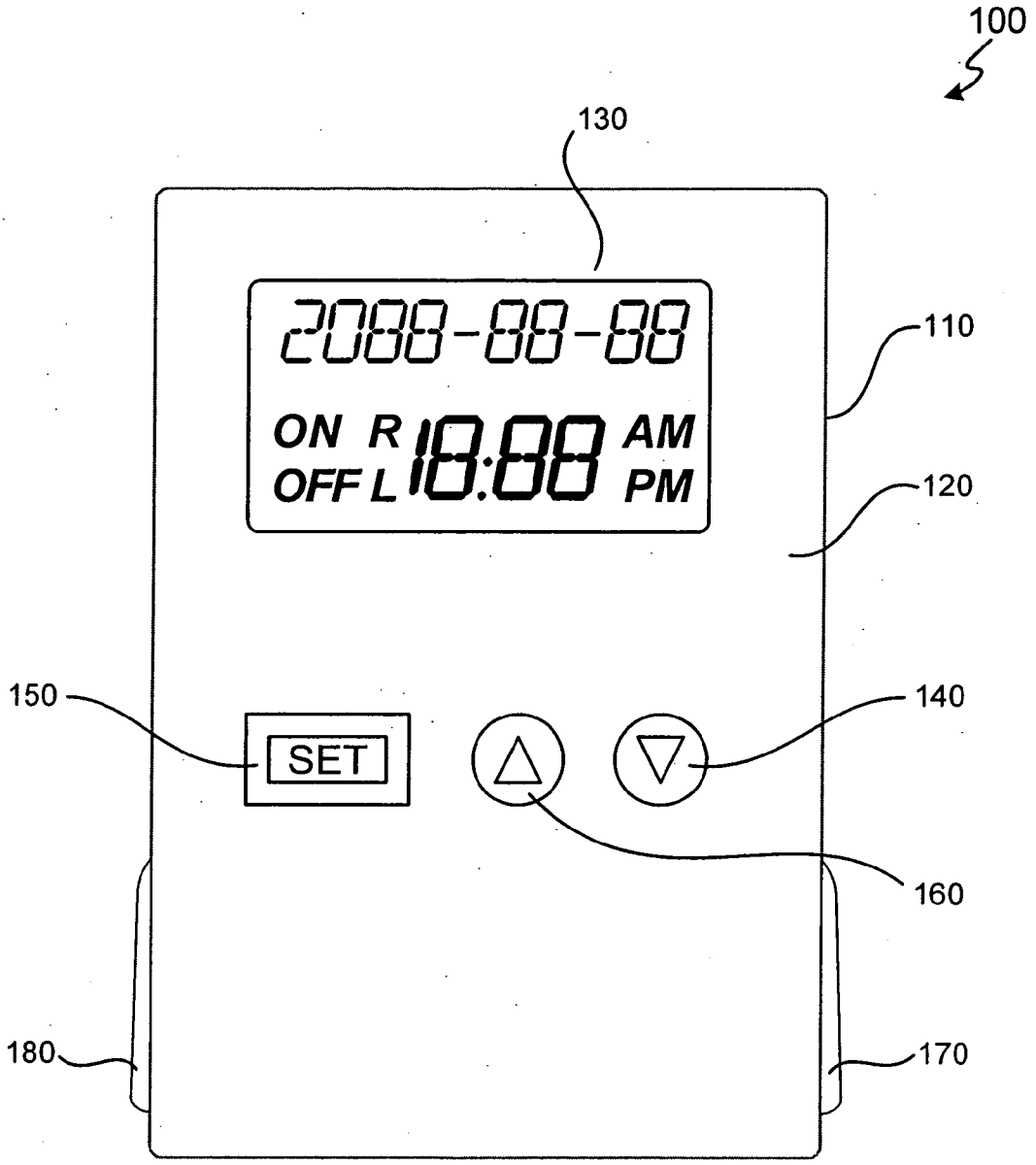

100
130
2088-88-88
ON R
OFF L
18:88
AM
PM
110
120
150
SET
140
160
180
170

FIG. 1

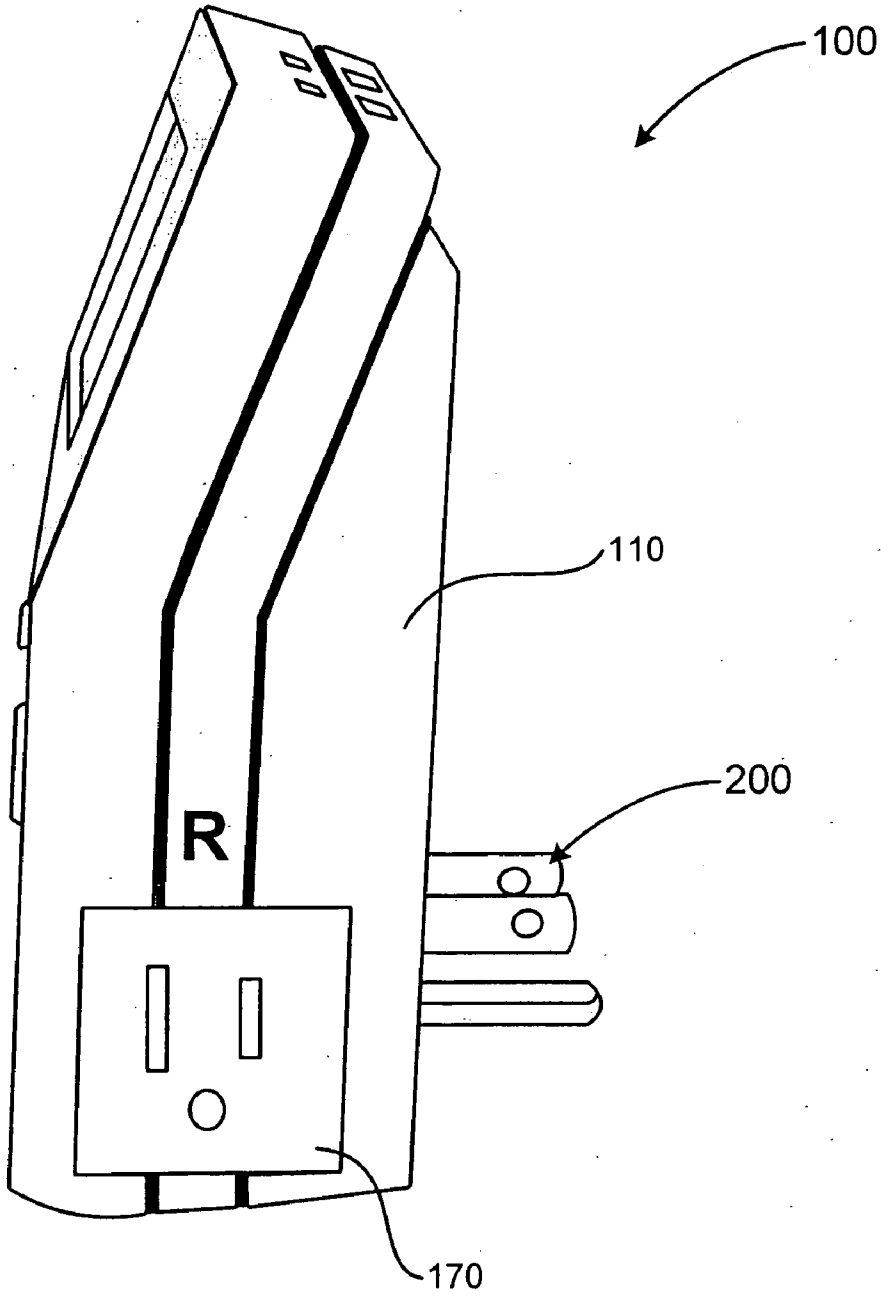


FIG. 2

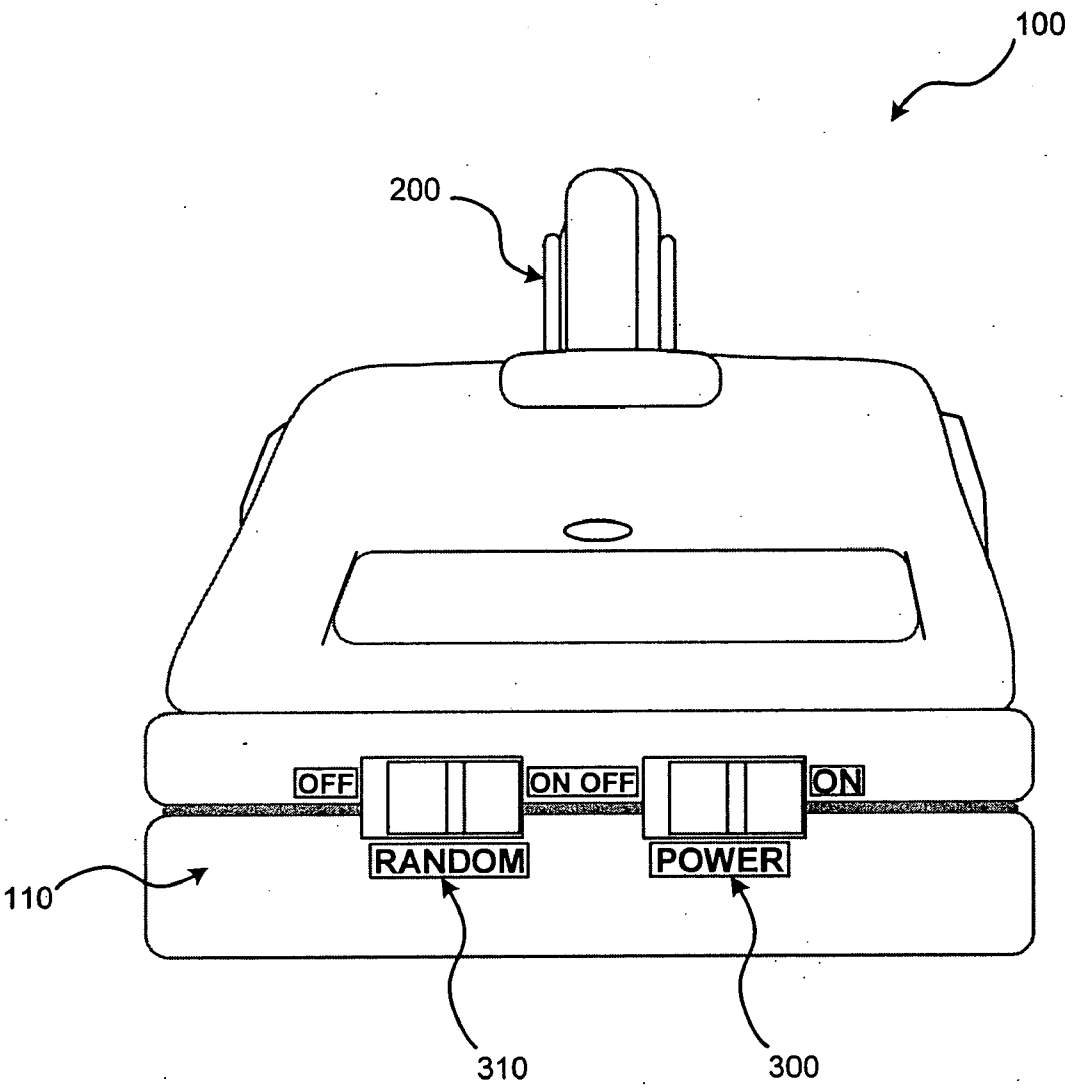


FIG. 3

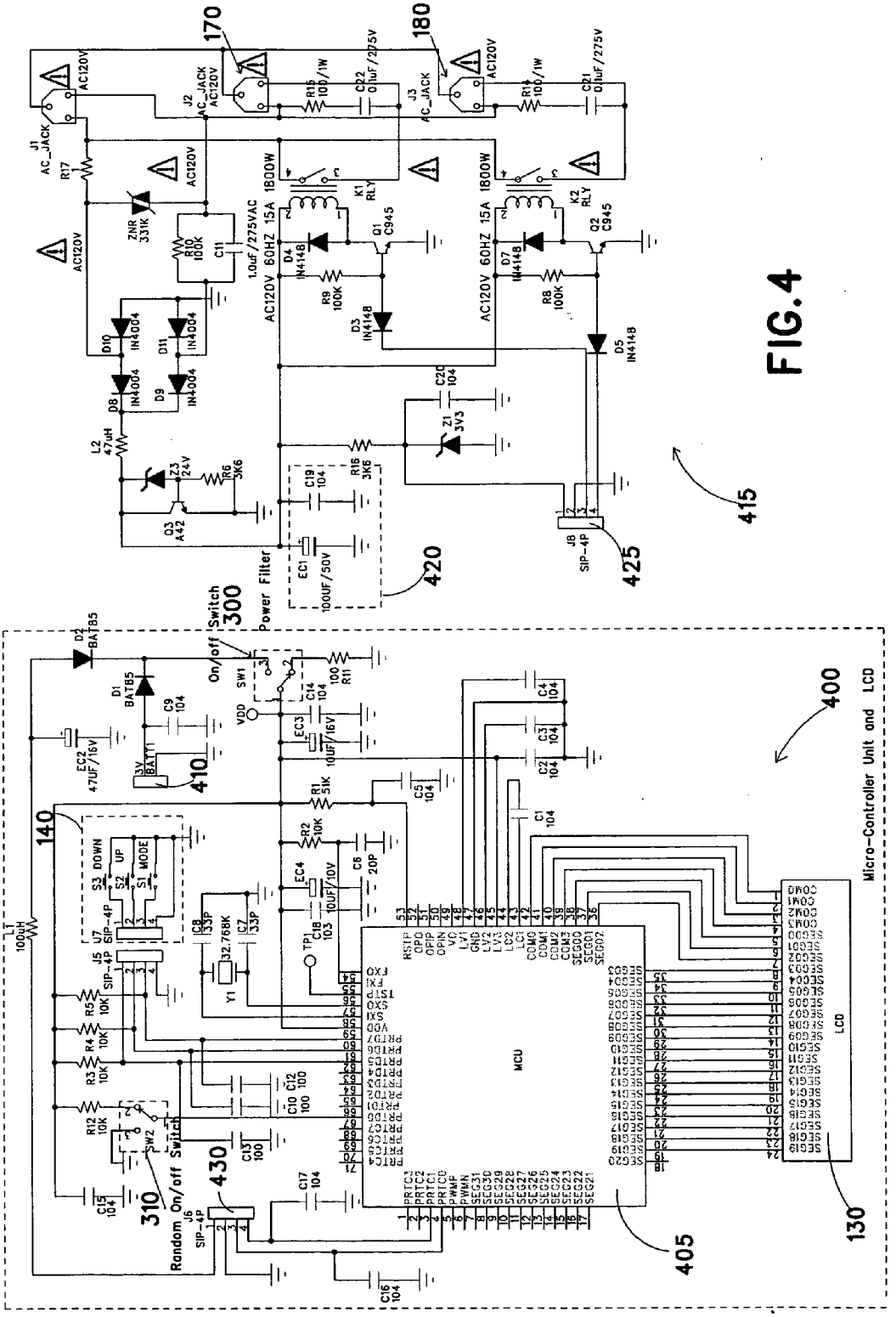

170
180
AC_JACK
AC120V
1800W
15A
60HZ
275VAC
1.0uF/275VAC
IN4004
IN4148
C945
ZNR 331K
L2 47uH
Z3 24V
Z1 3V3
A42
Power Filter
EC1 100UF/50V
420
415
425
J8 SIP-4P
Switch
300
On/off
SW1
BAT85
BATT1
410
MCU
Micro-Controller Unit and LCD
LCD
400
405
130
140
S3 DOWN
S2 UP
S1 MODE
J5 SIP-4P
U7
32.768K
Y1
TP1
SW2
310
Random On/off Switch
J6 SIP-4P
430

FIG.4

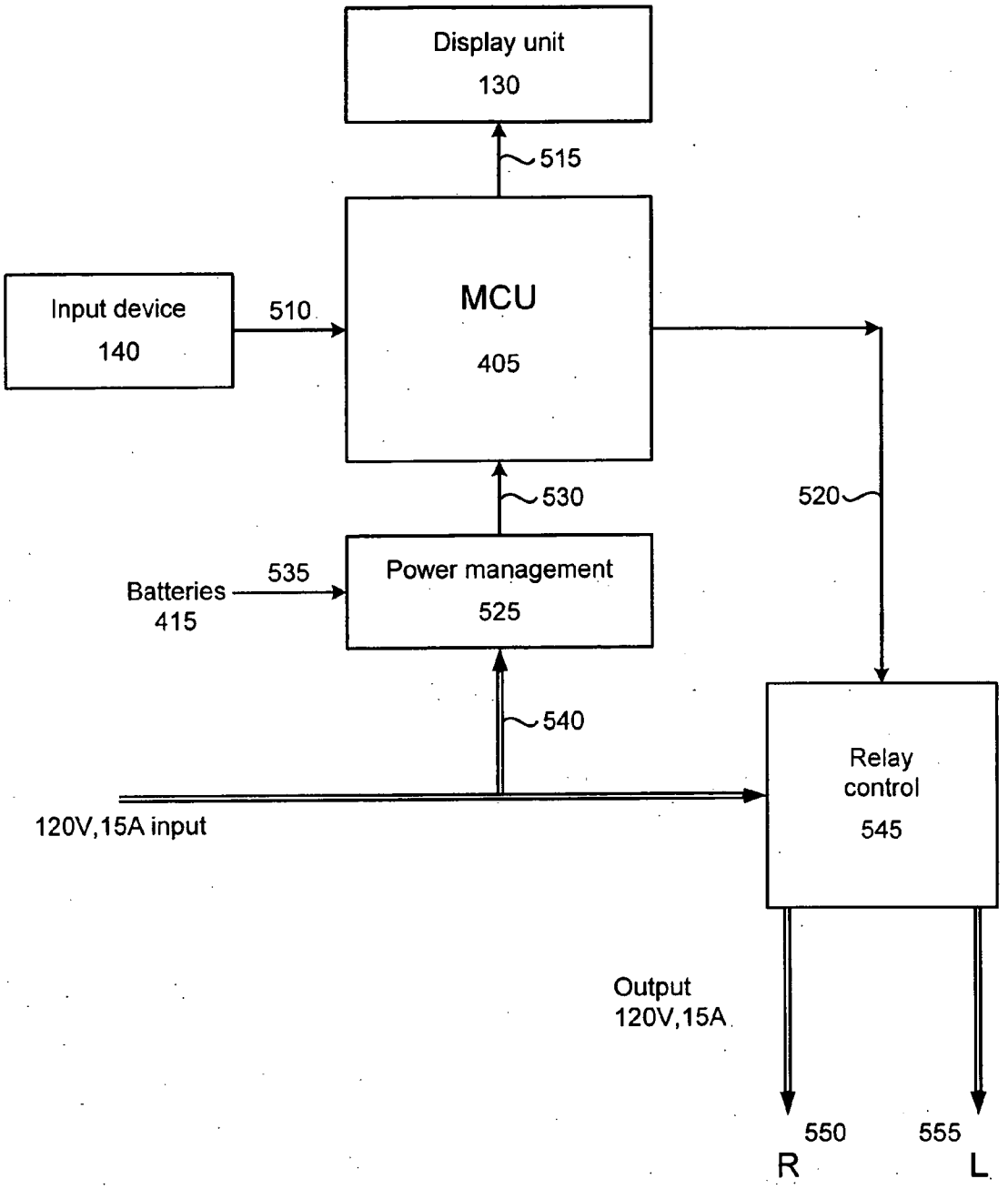

Display unit
130
515
MCU
405
Input device
140
510
530
520
Batteries
415
535
Power management
525
540
Relay
control
545
120V,15A input
Output
120V,15A
550
555
R
L

FIG. 5

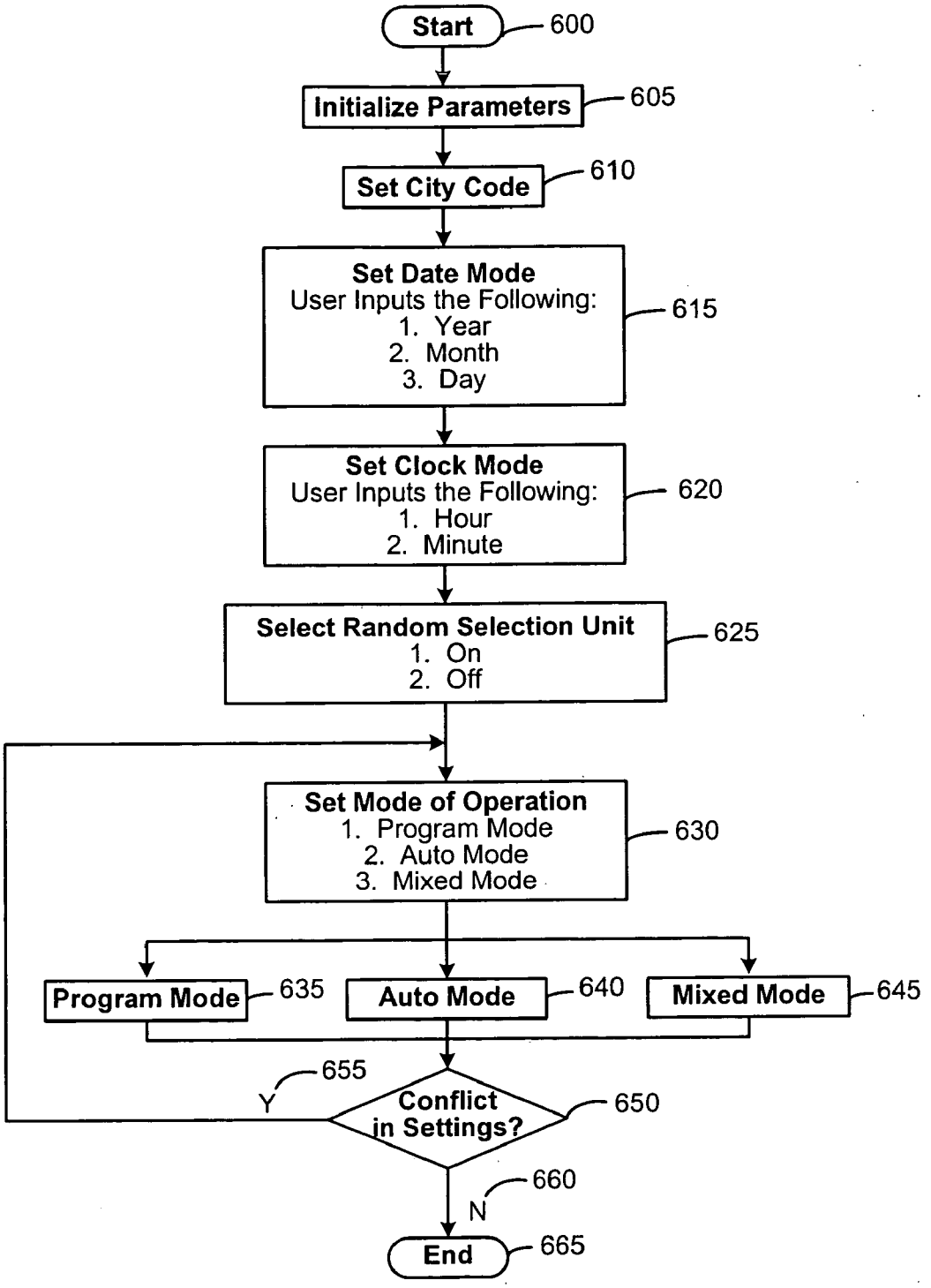

Start
600
Initialize Parameters
605
Set City Code
610
Set Date Mode
User Inputs the Following:
1. Year
2. Month
3. Day
615
Set Clock Mode
User Inputs the Following:
1. Hour
2. Minute
620
Select Random Selection Unit
1. On
2. Off
625
Set Mode of Operation
1. Program Mode
2. Auto Mode
3. Mixed Mode
630
Program Mode
635
Auto Mode
640
Mixed Mode
645
655
Y
Conflict in Settings?
650
660
N
End
665

FIG. 6

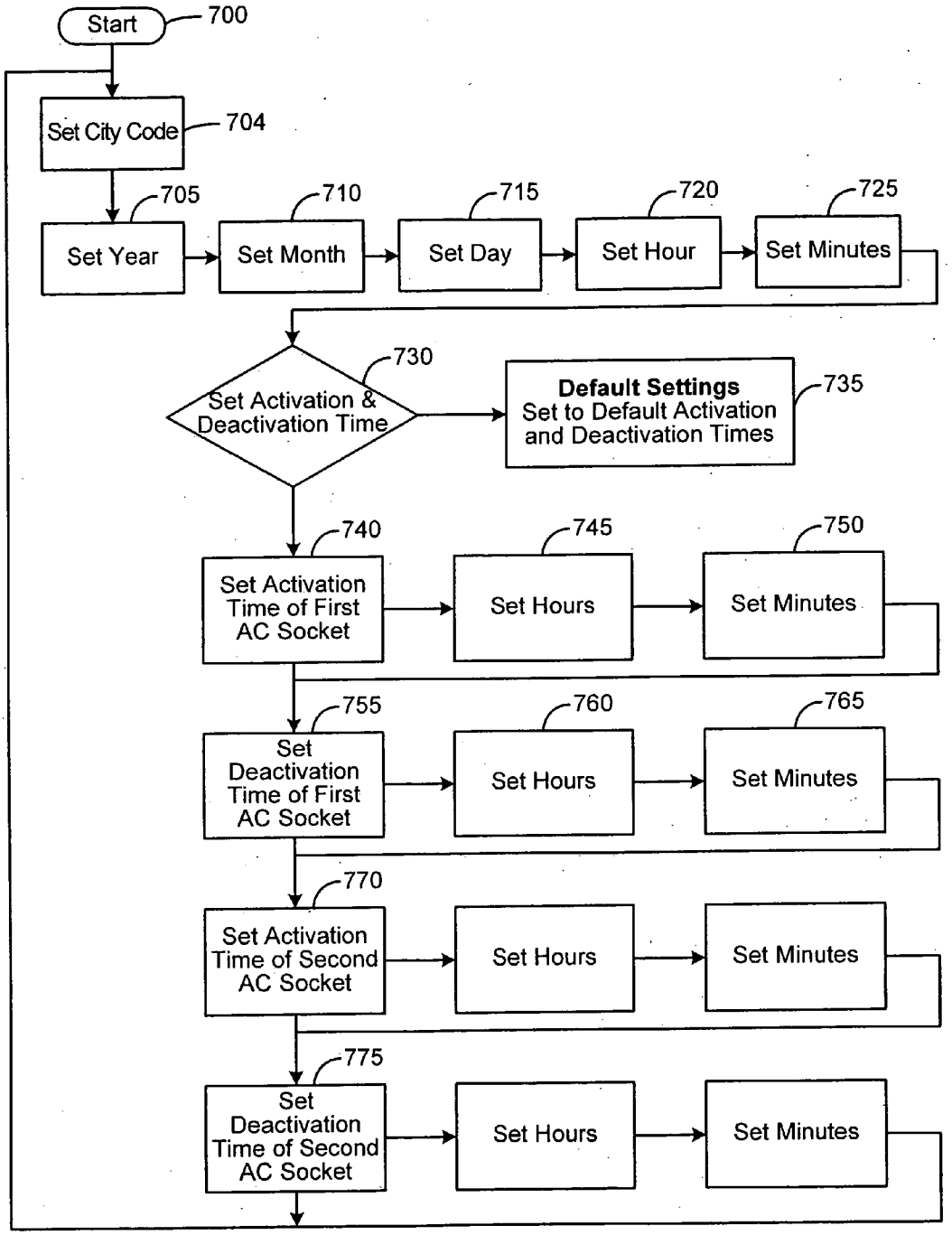

Start
700
Set City Code
704
705
Set Year
710
Set Month
715
Set Day
720
Set Hour
725
Set Minutes
730
Set Activation & Deactivation Time
Default Settings
Set to Default Activation and Deactivation Times
735
740
Set Activation Time of First AC Socket
745
Set Hours
750
Set Minutes
755
Set Deactivation Time of First AC Socket
760
Set Hours
765
Set Minutes
770
Set Activation Time of Second AC Socket
Set Hours
Set Minutes
775
Set Deactivation Time of Second AC Socket
Set Hours
Set Minutes

FIG. 7

ELECTRONIC TIMER

FIELD OF THE INVENTION

[0001] The invention relates generally to electronic timers that activate or deactivate electrical devices such as lights. More particularly, the invention relates to timers programmed to turn a light on and off at predetermined times that correspond to the geographic location of the user or at random times operating within programmed temporal parameters.

DESCRIPTION OF THE RELATED ART

[0002] Conventional electrical timers are commonly used to turn lights on and off in a dwelling or business, thereby, giving the appearance that the premises is occupied. This helps in deterring burglars from breaking into the premises when its occupants are away.

[0003] Electrical timers also provide illumination that helps reduce accidents associated with insufficient illumination.

[0004] One of the problems associated with these timers is that they turn on the same lights every night at the same selected activation time. One can easily ascertain that the house is not occupied by observing this repetitive operation over a period of days. Some timers allow lights to turn on at random times within a preselected random time interval of a selected activation time. Typically, the preselected random time interval is within 15-20 minutes of the selected activation time. This random operation avoids the repetitive activation time of conventional electronic timers. Normally, the programming of multiple random times is so difficult that most consumers abandon the effort.

[0005] Even the electronic timers with random operation have limitations. For instance, the timers may not adjust to daylight savings time and would require the user to update the timer's clock setting. Furthermore, even if the timers are advanced enough to correct for daylight savings time, they do not adjust for the varying sunset times throughout the year. Hence, if a user sets the timer to turn on at around 9 pm during the summer, he or she will have to readjust the timer settings in the fall and winter to correspond to an earlier sunset time. Adjustments are required more frequently when the sun is in the mid-latitudes, moving North or South. Most home or business owners do not have the time or opportunity to constantly tune their timers.

[0006] While U.S. Pat. No. 4,922,407 discloses an astronomical timer unit that can be preset to operate at dusk or dawn, this system also has limitations. It requires the user to enter local time of sunrise or the local time of sunset on the particular month and day to which the clock is currently set, and then uses an algorithm to calculate the subsequent times of local sunrise and sunset based on the time of year and the geographical location of the timer. Not only is this system susceptible to human error by virtue of entering the wrong sunset or sunrise times, it is also inaccurate because the algorithm only provides an estimate and not the exact sunset time.

[0007] Some electronic devices activate and deactivate their switching mechanism in response to photocell sensors. The sensor detects arrival of nighttime and automatically turns on the light after a certain time period from nightfall. These devices, such as the one disclosed in U.S. Pat. No. 4,575,659, require a photocell arrangement that increase the cost and complexity of the electronic timer unit. Furthermore, these photocell devices do not incorporate randomizing features, nor can they be precisely programmed to activate and deactivate at set times. They are also restricted to activating one device as they have only one socket.

[0008] While many of these timers work to turn the lights on and off, they fail to accurately account for the different sunset times corresponding to the user's geographic location and the time of year. Accordingly, it is an object of the present invention to provide an electronic timer that is programmed with accurate sunset and/or sunrise information specifically for a user's geographic location—latitude and longitude. The latter determines the user's location within a given time zone, which is compensated by the programming in the electronics.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The exact nature of this invention, as well as the objects and advantages thereof, will become readily apparent from consideration of the following specification in conjunction with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

[0010] FIG. **1** is a front view of an actual electronic timer incorporating an embodiment of the present invention.

[0011] FIG. **2** is a side view of an actual electronic timer incorporating an embodiment of the present invention.

[0012] FIG. **3** is a top view of an actual electronic timer incorporating an embodiment of the present invention.

[0013] FIG. **4** is a circuit design of an electronic timer incorporating an embodiment of the present invention.

[0014] FIG. **5** is a block design of an electronic timer incorporating an embodiment of the present invention.

[0015] FIG. **6** is a flow chart of the operation of an electronic timer incorporating an embodiment of the present invention.

[0016] FIG. **7** is a flow chart of a program executed by the processor in an electronic timer incorporating an embodiment of the present invention.

SUMMARY OF THE INVENTION

[0017] The present invention provides an electronic timer with stored astronomical data such as sunset, sunrise, evening, dawn or twilight data, for a specific geographic location that is used in setting an activation time.

[0018] The stored astronomical data could also be for multiple geographic locations. A user selects a city or country from the data base, or simply enters a city or country code, to trigger the processor to retrieve the appropriate astronomical data from memory.

[0019] A random selection unit randomly selects a time in a pre-selected random time interval on either side of an activation time. For instance, the electronic timer can be set to randomly activate within a pre-selected of 15 minute time interval from evening twilight onset.

[0020] The random selection unit adjusts activation time on any operating day by an amount corresponding to the time difference or deviation between the astronomical data for that operating day and the astronomical data that the user entered. A new random activation or deactivation time will be set within the pre-selected 15 minute time interval, based on the adjusted activation or deactivation times.

[0021] More than one AC socket may be provided. Each AC socket operates independently from the other. A random selection unit selects the activation time for each AC socket separated by a pre-selected minimum time interval.

DETAILED DESCRIPTION

[0022] Methods and apparatus that implement the embodiments of the various features of the invention will now be described with reference to the drawings. The drawings and the associated descriptions are provided to illustrate embodiments of the invention and not to limit the scope of the invention. Reference in the specification to "one embodiment" or "an embodiment" is intended to indicate that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least an embodiment of the invention. The appearances of the phrase "in one embodiment" or "an embodiment" in various places in the specification are not necessarily all referring to the same embodiment. Throughout the drawings, like reference numbers represent like elements.

[0023] FIG. **1** illustrates the front of an actual electronic timer **100**. The actual electronic timer **100** has a housing **110** with a face **120**. A display unit **130** and an input device **140** are mounted on the face **120** of the housing **110**. The display unit **130** can be a conventional liquid crystal display screen. An input device **140** can be a set of buttons or a touchpad screen for entry of selected information. In one embodiment, the input device **140** has three buttons: a mode/set button **150** for selecting the electronic timer's mode of operation, and scroll buttons **160** for moving up or down a list of information. The selected information can be any information that a user can enter or select using the input device **140**. The information can be any information stored in memory, such as astronomical sunset, sunrise, evening, dawn or twilight data, listing of geographical locations, and date and time information such as Standard Time ("ST") and Daylight Savings Time ("DT").

[0024] The electronic timer **100** can have more than one grounded AC socket. Each socket can be programmed to operate independently of the other. In one embodiment, the housing **110** contains a first AC socket **170** and a second AC socket **180**, mounted on opposite sides of the housing **110**.

[0025] FIG. **2** illustrates a side view of the electronic timer **100** with the first AC socket **170** mounted on one side of housing **110**. Extending from the rear side of the electronic timer **100** is a conventional plug **200** for insertion into a conventional AC socket. The plug **200** may be a 3-prong or a 2-prong plug.

[0026] FIG. **3** shows a top view of the electronic timer **100**. The electronic timer **100** has a power switch **300** mounted on the top side of housing **110**. The power switch **300** controls the power supply transmitted to the two AC sockets **170** and **180**. The power switch **300** can be set mechanically using a slide switch, or can be set electronically using the input device **140**. The power switch **300** can be used to control the power supply to all AC sockets **170** and **180** simultaneously, or control the power supply to each AC socket **170** and **180**, selectively.

[0027] Mounted in housing **110** is a random selection unit. The random selection unit can be set mechanically using, for example, the slide switch **310**, or electronically using, the input device **140**. The electronic timer **100** can have one random selection unit **310** to control the activation and deactivation of all AC sockets **170** and **180**. The electronic timer **100** can also have separate random activation units for each AC socket **170** and **180**, such that the user can select which AC socket **170** or **180** would operate randomly.

[0028] When the random selection unit **310** is switched on, a time is selected, at random, within a pre-selected time interval of an activation or deactivation time. For example, if the activation time was set to 6:00 P.M., the timer with a pre-selected time interval of plus or minus fifteen minutes will turn on at some time between 5:45 P.M. and 6:15 P.M. If the random selection unit **310** is switched off, the electronic timer **100** will operate at substantially the set activation and deactivation times.

[0029] The user can also set the activation and deactivation times of the electronic timer **100** using the input device **140** to enter the operating times. The activation and deactivation times can also be preprogrammed by the manufacturer. For example, the activation and deactivation times can be retrieved from a memory containing astronomical data such as sunset and sunrise times. The activation or deactivation times can be set at a time substantially equal to the astronomical data. Both activation and deactivation time settings can adjust for daylight savings time change. In one embodiment, the deactivation time can be preprogrammed to turn off after a certain time period from the activation time. For instance, the deactivation time can be set to turn off after five hours from the activation time. In another embodiment, the deactivation time can be preprogrammed to turn off at a specific time for a specific location. For example, the deactivation time can be set to turn off at 11:30 P.M. for all locations, except Alaska where it would turn off at 12:30 A.M.

[0030] Table 1 provides exemplary astronomical sunset data for the city of Los Angeles in March. The first column of Table 1, lists the dates in the month. The second column lists corresponding sunset data for a geographical location. This data may be obtained from the U.S. Naval Observatory. The third column indicates the activation time stored in the electronic timer **100**. This time is set to be substantially equal to the astronomical data. The fourth column shows the expected activation time of the timer. If the random selection unit **310** is switched on, the activation time is set to equal the activation time in column 3. The fifth column provides an exemplary list of times that the electronic timer **100** turns on. If the random selection unit **310** is switched on, the time is randomly selected within a pre-selected time interval of 15 minutes from the expected activation time of column 4. The sixth column lists the expected deactivation time, which is preset to turn off the electronic timer **100** after five hours from the expected activation time. The seventh column provides an exemplary list of times that the electronic timer **100** turns off. These times are within a pre-selected time interval of 15 minutes from the expected deactivation time.

TABLE 1

Date	Actual Sunset Data	Stored Sunset Data	Expected Activation Time	Actual Activation Time	Expected Deactivation Time	Actual Deactivation Time
3.1	17:50	17:51	17:51	17:51	22:51	22:51
3.2	17:51	17:51	17:51	17:57	22:51	22:52
3.3	17:52	17:52	17:52	18:04	22:52	22:42
3.4	17:53	17:53	17:53	17:50	22:53	22:54
3.5	17:54	17:54	17:54	18:04	22:54	23:00
3.6	17:54	17:55	17:55	17:53	22:55	22:50
3.7	17:55	17:56	17:56	17:54	22:56	23:03
3.8	17:56	17:57	17:57	18:11	22:57	23:08
3.9	17:57	17:57	17:57	18:03	22:57	22:51
3.10	17:58	17:58	17:58	17:57	22:58	22:47
3.11	17:59	17:59	17:59	17:58	22:59	22:53
3.12	17:59	18:00	18:00	18:02	23:00	22:48
3.13	18:00	18:00	18:00	18:09	23:00	22:58
3.14	18:01	18:01	18:01	17:48	23:01	23:11
3.15	18:02	18:02	18:02	17:50	23:02	23:05
3.16	18:02	18:03	18:03	17:50	23:03	23:13
3.17	18:03	18:03	18:03	17:55	23:03	23:18
3.18	18:04	18:04	18:04	17:54	23:04	23:18
3.19	18:05	18:05	18:05	18:04	23:05	23:04
3.20	18:06	18:06	18:06	18:10	23:06	23:01
3.21	18:06	18:06	18:06	17:57	23:06	22:55
3.22	18:07	18:07	18:07	17:57	23:07	22:58
3.23	18:08	18:08	18:08	17:58	23:08	23:20
3.24	18:09	18:09	18:09	18:18	23:09	23:24
3.25	18:09	18:10	18:10	18:12	23:10	22:56
3.26	18:10	18:10	18:10	18:09	23:10	22:56
3.27	18:11	18:11	18:11	18:08	23:11	22:58
3.28	18:12	18:12	18:12	18:13	23:12	23:23
3.29	18:12	18:13	18:13	18:21	23:13	23:18
3.30	18:13	18:13	18:13	18:19	23:13	23:12
3.31	18:14	18:14	18:14	18:07	23:14	23:24

[0031] The random selection unit **310** can trigger the processor of the electronic timer **100** to adjust the activation or deactivation times set by a user. If the random selection unit is switched on, the activation and/or deactivation times set by the user can be adjusted by an amount corresponding to the time difference between a reference time, such as a time retrieved from astronomical data on the day the timer is set by the user, and a time retrieved from astronomical data on the operating day. This is illustrated in Table 2. If the sunset time stored in the electronic timer **100** for March 1st is 5:51 P.M. (Table 2, Col. 3, Row 1), and the user sets the activation time as 7:00 A.M. and deactivation time as 9:00 A.M., then on March 3rd, with a stored sunset time of 5:52 P.M., the random selection unit **310** will trigger the processor to adjust the activation and deactivation times by the time difference between 5:51 P.M. and 5:52 P.M., one second. The adjusted expected activation time is 7:01 A.M. and the adjusted expected deactivation time is 9:01 A.M. If the random selection unit is switched on, a random time is selected within a pre-selected random time interval on either side of the adjusted expected activation and/or adjusted expected deactivation times (as shown in Table 2, Cols. 5 & 7).

TABLE 2

Date	Actual Sunset Data	Stored Sunset Data	Expected Activation Time	Actual Activation Time	Expected Deactivation Time	Actual Deactivation Time
3.1	17:50	17:51	7:00	7:00	9:00	9:00
3.2	17:51	17:51	7:00	6:47	9:00	8:51
3.3	17:52	17:52	7:01	7:07	9:01	9:12
3.4	17:53	17:53	7:02	6:58	9:02	8:56
3.5	17:54	17:54	7:03	7:15	9:03	8:57
3.6	17:54	17:55	7:04	6:51	9:04	8:56
3.7	17:55	17:56	7:05	7:18	9:05	9:18
3.8	17:56	17:57	7:06	7:02	9:06	9:03
3.9	17:57	17:57	7:06	6:59	9:06	9:18
3.10	17:58	17:58	7:07	7:07	9:07	9:12
3.11	17:59	17:59	7:08	7:00	9:08	9:54
3.12	17:59	18:00	7:09	7:08	9:09	9:17
3.13	18:00	18:00	7:09	7:18	9:09	9:03
3.14	18:01	18:01	7:10	7:01	9:10	8:55
3.15	18:02	18:02	7:11	7:12	9:11	9:15
3.16	18:02	18:03	7:12	7:10	9:12	9:24
3.17	18:03	18:03	7:12	7:05	9:12	9:13
3.18	18:04	18:04	7:13	7:05	9:13	9:26
3.19	18:05	18:05	7:14	7:06	9:14	9:26
3.20	18:06	18:06	7:15	7:15	9:15	9:30
3.21	18:06	18:06	7:15	7:04	9:15	9:30
3.22	18:07	18:07	7:16	7:06	9:16	9:29
3.23	18:08	18:08	7:17	7:10	9:17	9:07
3.24	18:09	18:09	7:18	7:18	9:18	9:03
3.25	18:09	18:10	7:19	7:28	9:19	9:24
3.26	18:10	18:10	7:19	7:19	9:19	9:12
3.27	18:11	18:11	7:20	7:05	9:20	9:10
3.28	18:12	18:12	7:21	7:24	9:21	9:35
3.29	18:12	18:13	7:22	7:13	9:22	9:29
3.30	18:13	18:13	7:22	7:36	9:22	9:14
3.31	18:14	18:14	7:23	7:24	9:23	9:29

[0032] FIG. **4** illustrates an exemplary schematic diagram of a circuit for an electronic timer **100**. The left circuit **400** represents a low voltage circuit comprising a display unit **130**, a Micro-Controller Unit (MCU) **405**, a battery **410**, and an input device **140**. The right circuit **415** represents the high voltage comprising AC sockets **170** and **180**, and AC Power Control **420**. The left circuit **400** and the right circuit **415** are connected through connection **425** and connection **430**. The MCU **405** could be a central processor unit, such as the one manufactured by Jess Technology Co., Ltd.

[0033] Referring to FIG. **5**, the MCU **405** processes selected information from the input device **140** (**510**), and outputs messages to the display unit **130** (**515**). The MCU **405** also provides functions such as calendar, random timing, and sunset tables for at least one geographical location. The MCU **405** controls the relays (**520**) of at least one AC socket **170** and **180**.

[0034] Power management **525** of FIG. **5** corresponds to circuit elements D**1**, D**2**, Z**1**, Z**3**, D**8**, D**9**, D**10**, D**11** of FIG. **4**. Power management **525** provides electrical power to the MCU **405** (**530**). If there is no AC input, the MCU **405** will use power from the battery **415** through D**1** (**535**). However, if the electronic timer **100** is plugged to a wall socket, the MCU **405** will use power from the AC line through circuit elements D**8**, D**9**, D**10**, D**11**, Z**3**, Z**1** and D**2** (**540**).

[0035] The MCU **405** controls **545** the two relays K**1** and K**2** through its output pins PRTC**0** (**550**) and PRTC**1** (**555**). These two signals, through J**6** and J**8**, are fed to D**3** and D**5**, and thus control the ON or OFF of the two relays.

[0036] FIG. **6** is a flow chart logic diagram depicting operation of an electronic timer **100**. In the first step, the processor initializes all relevant parameters (**605**). In one mode of operation, the user is prompted to set a city code (**610**) by using the input device **140**. In another mode of operation, the user can select a geographical location from a preprogrammed list of cities and/or countries. Through successive use of the mode button **150**, the user can scroll through all the programmed options, including date mode (**615**) and clock mode (**620**), and set all relevant selected information. It will be recognized that any or all selected information can be preprogrammed by the manufacturer without requiring the user to input any information in the electronic timer **100**.

[0037] Next, the processor checks if the random selection unit **310** is switched on or off (**625**). If the random selection unit **310** is switched off, then the electronic timer will operate at a time substantially equal to the activation and deactivation times. Since the activation and deactivation times can be set by the user or preprogrammed by the manufacturer, the processor checks which mode of operation (**630**) is set for the electronic timer **100**. There can be three modes of operation: program mode (**635**), auto mode (**640**), and mixed mode (**645**). The program mode (**635**) allows the user to set the activation and deactivation times for each AC socket **170** and **180**. The auto mode (**640**) does not require the user to set any operating times. The electronic timer **100** will retrieve astronomical data, such as sunset, sunrise, evening, dawn or twilight times, from memory and use this information to automatically set activation and deactivation times for each AC socket **170** and **180**.

[0038] The mixed mode (**645**) allows the user to input either an activation time or a deactivation time for each AC socket **170** and **180**. If the user chooses to enter an activation time but not a deactivation time, the electronic timer **100** will turn on at the time set by the user and turn off at a pre-set time, such as 11:30 P.M. for all locations, except Alaska where it would turn off at 12:30 A.M. If the user enters a deactivation time only, the electronic timer **100** can retrieve sunset, sunrise, evening, dawn or twilight times from memory for activation time settings.

[0039] If the random selection unit **310** is switched on, then the electronic timer **100** will randomly select an operating time in a pre-selected random time interval on either side of the activation and deactivation times. In one mode of operation, the electronic timer **100** will randomly select different operating times for each operating day. The electronic timer **100** can be preprogrammed to randomly select an operating time outside a pre-selected minimum random time interval on either side of a previous operating time. For example, if the activation time is set at 4:58 P.M., then on the first operating day the random selection unit **310** can randomly select a time within a plus or minus fifteen minute deviation from 4:58 P.M., for instance, 4:51 P.M. On the second operating day, the random selection unit **310** would select a time outside a thirty minute window from the previous day such that the time is no later than 4:36 P.M. and not earlier than 5:06 P.M.

[0040] After determining the mode of operation, the processor dynamically checks (**650**) for improper settings. The processor can dynamically check if the activation and deactivation times are greater than a pre-selected minimum operating time interval. For example, the time interval between activation and deactivation must be greater than or equal to five minutes. In one embodiment, the pre-selected minimum operating time interval is different if the random selection unit **310** is switched on. For instance, the time interval between a randomly selected activation time and a randomly selected deactivation time should be greater than 31 minutes. Also, the processor dynamically checks if the activation time between each AC socket **170** and **180** is greater than a pre-selected minimum time interval. If the timer has detected that there is a conflict (**655**) with the rules in setting the electronic timer **100**, the processor will clear all improper settings and automatically return to the setting interface to ask for resetting. However, if there are no conflicts (**660**) with the setting rules, then the processor will provide power supply to AC sockets **170** and **180** at the set operating time (**665**).

[0041] FIG. **7** is a flow chart showing a sequence of programmed processes occurring within the processor of an electronic timer **100**. The user can use the mode button **150** to circulate through all the settings for entry of selected information. In one embodiment, the user can set a city code (**704**). The user is directed to an accompanying user manual with a listing of city codes. The default setting is "001" referring to New York, N.Y. The user can use the scroll buttons **160** to select the correct code corresponding to the user's geographical location. In another embodiment, the user can use the scroll buttons **160** to select a geographical location from a preprogrammed list of cities and/or countries or use the input device **140** to type in the geographical location.

[0042] Through successive use of the mode button **150**, the user can set the year (**705**), the month (**710**), the day (**715**), the hour (**720**), the minutes (**725**), and activation and deactivation times (**730**). If the user does not set activation and deactivation times, then the electronic timer **100** will operate at the default settings. For example, the default or expected activation time can be a time substantially equal to sunset, sunrise, evening, dawn or twilight times. The default or expected deactivation time can be preprogrammed to turn off after a certain time period, for instance five hours, from the activation time. In one embodiment, the default deactivation time can be preprogrammed to turn off at a specific time for a specific location. For example, the default deactivation time can be set to turn off at 11:30 P.M. for all locations, except Alaska where it would turn off at 12:30 A.M.

[0043] If the user chooses to input activation and/or deactivation times for each AC socket **170** and **180**, then the user must enter some selected information. The user can set the activation time (**740**) for the first AC socket **170** by entering the hours (**745**) and the minutes (**750**). Next, the user can set the deactivation time (**755**) of the first AC socket, also by entering the hours (**760**) and the minutes (**765**). Finally, the user can set the activation time (**770**) and deactivation time (**775**) of the second AC socket **180** in a similar fashion. The user can choose to keep the default settings for activation but only set the deactivation time, in which case the user would not enter an activation time. Similarly, the user also has the option of keeping the default settings for the deactivation time but only set the activation time. In either case, the processor would operate in mixed mode (**645**). It can be recognized to a person skilled in the art that any or all selected information can be preprogrammed by the manufacturer without requiring the user to input any programming information.

[0044] While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to

be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other changes, combinations, omissions, modifications and substitutions, in addition to those set forth in the above paragraphs, are possible. Those skilled in the art will appreciate that various adaptations and modifications of the just described preferred embodiment can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described herein.

What is claimed is:

1. An electronic timer comprising:

a memory for storing information including astronomical data of a geographic location used in setting an operating time for the electronic timer, the astronomical data being at least one of a sunset, sunrise, evening, dawn or twilight time;

a processor using the astronomical data to generate a time controlled signal; and

a switch, responsive to the time controlled signal, for receiving an input power from a power supply and coupling the input power to at least one AC socket.

2. The electronic timer of claim 1, wherein the operating time extends for substantially five hours from an activation time.

3. The electronic timer of claim 1, wherein the operating time is greater than a pre-selected minimum operating time interval.

4. The electronic timer of claim 1 further comprises an input device coupled to the processor, for entry of selected information comprising at least one of a geographic location code, a geographic location, a year, a month, a date, a time, and a mode of operation.

5. The electronic timer of claim 1 further comprises a power switch for controlling the power supply.

6. The electronic timer of claim 1, wherein each AC socket operates independently from one another.

7. The electronic timer of claim 1, further comprises a display unit coupled to the processor.

8. The electronic timer of claim 1 further comprises a random selection unit used to select, at random, a time in a preselected random time interval on either side of a reference operating time comprising at least one of the activation time or a deactivation time.

9. The electronic timer of claim 8, wherein the time, randomly selected from a preselected random time interval on the operating day, is separated from a previous randomly selected time of a previous day by a preselected minimum random time interval.

10. The electronic timer of claim 8,

wherein each AC socket operates independently,

wherein the random selection unit randomly selects at least one of the activation time or the deactivation time for each AC socket, and

wherein at least one of the activation time or the deactivation time for one AC socket is separated from that of another AC socket by a preselected minimum time interval.

11. The electronic timer of claim 8, wherein the random selection unit triggers the processor to adjust the reference operating time on the operating day by an amount corresponding to a time difference between the astronomical data of a reference day and the astronomical data of the operating day.

12. The electronic timer of claim 11, wherein the reference day is the date entered for the selected information.

13. An electronic timer comprising:

a memory for storing information including astronomical data of a geographic location, the astronomical data being of at least one of a sunset time and a sunrise time;

a processor using the astronomical data for generating a time controlled signal;

a switch, responsive to the time controlled signal, for receiving an input power from a power supply and coupling the input power to at least one AC socket;

a display unit coupled to the processor; and

a means for inputting selected information, the selected information comprising at least one of a geographic location code, a geographical location, a year, a month, a date, a time, and a mode of operation.

14. The electronic timer of claim 13, wherein each AC socket operates independently from one another.

15. The electronic timer of claim 13, wherein the operating time extends beyond an activation time by a preset time.

16. The electronic timer of claim 13 further comprises a random selection means for selecting, at random, a time in a preselected random time interval on either side of a reference operating time comprising at least one of the activation time or a deactivation time.

17. The electronic timer of claim 16, wherein the time, randomly selected from a preselected random time interval on the operating day, is separated from a previous randomly selected time of a previous day by a preselected minimum random time interval.

18. The electronic timer of claim 16, wherein each AC socket operates independently, and the random selection means selects, at random, the activation time for each AC socket separated by a preselected minimum time interval from each other.

19. The electronic timer of claim 16, wherein the random selection means triggers the processor to adjust the reference operating time on the operating day by an amount corresponding to a time difference between the astronomical data of the operating day and the astronomical data of the date entered for the selected information.

20. A method for programming an electronic timer comprising the steps of:

retrieving from memory information including astronomical data for more than one day of a geographic location, the astronomical data being at least one of a sunset time and a sunrise time;

generating a time controlled signal based on the information retrieved from memory;

activating at least one AC socket upon receipt of the time controlled signal; and

deactivating at least one AC socket upon expiration of operating time; the operating time extends beyond an activation time by a preset time.

21. The method of claim 20, further comprises the step of generating random operating times that are within a preselected random time interval on the operating day and separated from a previous randomly selected time of a previous day by a preselected minimum random time interval.

22. The method of claim 20, further comprises the step of generating a random activation time for each AC socket, wherein each random activation time is separated from one another by a pre-selected minimum time interval.

23. The method of claim 20, further comprises the step of generating a random deactivation time for each AC socket, wherein each random deactivation time is separated from one another by a pre-selected minimum time interval.

24. The method of claim 20, further comprises the step of generating random operating times within a preselected random time interval on either side of a reference operating time comprising at least one of the activation time or a deactivation time.

25. The method of claim 23, further comprises the step of adjusting the reference operating time on the operating day by an amount corresponding to a time difference between the astronomical data of a reference day and the astronomical data of the operating day.

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